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(54) **Interlocking modular element carpets for sport matches such as wrestling, karate, judo and the like and a method for making same**

(57) A rigid carpet structure (10) for particular sport matches consisting of at least three layers (12, 14, 12') of a polymeric closed cell foam material, the outer layers (12, 12') of which have a density greater than that of the inner layer (14) and are preferably differently coloured.

The thickness (b) of the inner layer is always greater than the thickness (a, a') of the outer layers. The

carpet is made of mating modular elements provided with corresponding groove-and-tongue elements which allow said modular elements to be easily engaged and disengaged, said groove-and-tongue elements being provided with such indentations that the mating side faces thereof form an angle of 45°.

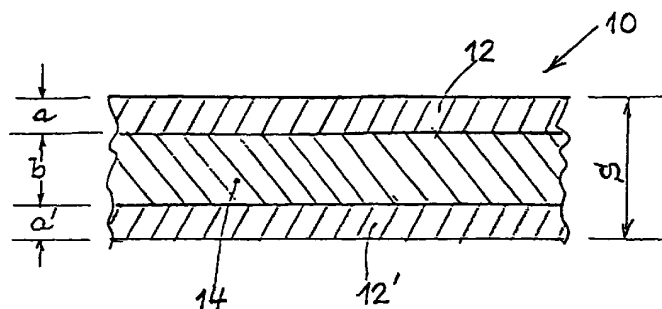


Fig.1

EP 0 890 373 A1

Description

The present invention relates to a rigid carpet, to be laid on the floor of an area, for performing thereon particular sport matches such as wrestling, judo, karate and the like, said rigid carpet being formed by interlocking modular elements.

The above mentioned carpets, for example the so-called "tatamis", have a size which defines the limits of the area within which the match should take place and they must meet several particular requirements, namely:

- provide good friction between their lower surface and the supporting floor in order to prevent undesirable displacements of the carpet in the course of the match, which would negatively affect the performance of the competitors;
- provide a non-slippery trampling surface and at the same time withstand a localized compression to prevent the competitors' feet from excessively sinking into the carpet and a possible unbalance of the competitors as well as too great a reduction of the force applied by the competitors' bodies;
- yet provide a sufficient resilient dampening in order to mitigate the impacts in case of falls.

Recently, single-layer polymeric foam material carpets have been made which, however, though varying in density, thickness and type, have not made it possible to reconcile, in the best manner desired, the opposing requirements of surface stiffness and surface consistency with an appropriate resilience for a localized impact thereupon.

The object of the present invention is to realize a modular carpet provided with a sufficiently rigid trampling surface to prevent the competitors' feet from excessively sinking into a localized area of the carpet, while exhibiting a sufficient overall resilience to prevent parts of the competitors' body, such as shoulders, wrists, hands and head, from being damaged in case of falls.

According to the invention, after extensive tests, a very satisfactory compromise has been achieved by using carpets consisting of multi-layer panels, in particular of three or more layers, made of a polymeric closed cell foam material, wherein the outer layers have preferably the same composition as, and a greater density than, the inner layer or layers formed by a less dense foam material which, consequently, will have a greater deformability and resilience.

The carpet according to the present invention is made of modular elements provided with corresponding peripheral indentations which allow the elements of the carpet to be easily engaged and disengaged, to be easily stored - when not in use - in a very restricted space, as well as to be easily transported and subjected to maintenance, washing or replacement, if damaged.

The patent contemplates that the outer layers be differently coloured in order to have available, at will, a surface, exposed to the view, of the colour desired, or even to form an aesthetically pleasing surface provided with alternating panels in a chessboard pattern

The invention also provides that, during the production stage of the carpet, the foam material surface layer, of greater density, to be exposed to the view or arranged in contact with the floor, be embossed in order to roughen its surface or that, alternatively, said layer be coated with an embossed film.

The invention shall now be described in detail having reference by way of example to an embodiment thereof, and to the drawings attached hereto wherein:

Figure 1 is a cross-sectional view of a panel element for a carpet intended for sport matches, according to the invention;

Figure 2 illustrates a series of diagrams relating to a polyethylene closed cell foam material of different densities, showing how the compression percent varies with respect to the applied pressure;

Figure 3 is a schematic top plan view of the peripheral indentations provided on two panel elements which allow said panel elements to be engaged in groove-and-tongue relationship in order to form, with a plurality of further like elements, a carpet having the desired dimensions;

Figure 4 is a top plan view of two joined panels provided with the indentations shown in Figure 3;

Figure 5 illustrates a linear border ledge to be joined by indentations for completing the peripheral border of a carpet according to the invention;

Figure 6 illustrates a bordering ledge element forming an angle for a carpet according to the invention; and

Figure 7 illustrates the constructional geometrical principle of the groove-and-tongue indentations adopted in the elements of the carpet according to the invention.

Figure 1 is a cross-sectional view of a modular carpet panel element according to the present invention, indicated by the numeral 10, which element, in this embodiment, consists of three superimposed layers 12, 14, 12', having respective thickness a, b, a'.

From test performed, it has been found that the thickness a, a' of the outer layers 12, 12', for example made of a polyethylene closed cell foam material, can vary from 5 to 25 mm, preferably from 10 to 20 mm, whereas the thickness b of the middle layer 14, for example made of a polyethylene closed cell foam material, must be greater and it can vary up to 2.5 times the thickness a of the top layer, preferably of from 1.5 to 2 times said thickness a.

Generally, the thickness of the outer layers 12, 12' may also be different, and this can prove useful when the carpet is meant to be used for matches between two

competitors of very different weight. In most cases, the thickness a and a' of the layers 12, 12' will preferably be the same, so as to allow the carpet to be reversed, while maintaining like physical properties.

Figure 1 illustrates, in particular, an embodiment by way of example of a carpet panel in which the layers 12, 12' have the same thickness of 10 mm, and a thickness b of the middle or inner layer 14 is of 15 mm. The total thickness S , in this case, is of 35 mm, with possible variations within the range of from 15 to 70 mm, depending on the type of match.

With respect to the carpet materials, it has been found that a suitable material is cross-linked closed cell foam polyethylene (PE), which can be made having a wide range of densities, varying, for example, from 25 to 200 kg/m³ and having different physical properties of compression and tensile strength.

Good results have been obtained by using a PE material of different densities, as sold by the very Applicant under the commercial tradename "POREX", and, more specifically, by using for the stiffer outer layers a density of from 30 to 200 kg/m³ and for the inner layer 14 a density ranging from 25 to 50 kg/m³.

The inner layer 14 is preferably made of a single density material, within the above mentioned range; however, it may also be formed by several layers, having even different densities.

Figure 2 shows several typical diagrams related to a polyethylene closed cell foam material of different densities.

From these diagrams it can be taken that for the embodiment cited by way of example in Figure 1, wherein:

$a = a' = 10$ mm with POREX material having a density of 120 kg/m³
 $b = 15$ mm with POREX material having a density of 30 kg/m³

to a localized impact of about 200 kPa, i.e. of about 200 kg/dm², there corresponds a depression of 40% of the layer a , i.e. a sinking of 4 mm of the outer layer and of 55% of the layer b , i.e. a sinking of 8.20 mm (of the inner layer) for a total of 12.2 mm, which values justify the dampening of the impacts encountered in practice, as compared with a normal sinking caused by a normal trampling by a person having a weight of 75 kg, which, under a pressure of about 25 kg/dm², causes a deflection of the carpet surface of about 1.5 mm.

The aim of providing a carpet having a multilayer structure according to the present invention, is that of reconciling the opposite requirements of making a structure having generally a sufficient surface stiffness to allow the competitors to keep their balance and to thrust themselves forward in an upright condition, while at the same time having a sufficient inner resilience to dampen impacts in case of falls, thereby preventing the competitor's body from suffering contusions or frac-

tures.

From practical tests it has been found that a localized impact on the layer 12 of greater density, which can originate dynamic pressures greater than 150 kPa, is diffused and dampened thanks to the resilient deflection of said layer 12 made possible by the yielding of the lower density inner layer 14.

The carpet according to the present invention is made of modular panels having either a rectangular or a square configuration and having such a size that they can be easily handled, transported and stacked.

The polyethylene closed cell cross-linked foam material, preferably used as construction material, has preferably a different colour for the outer layers 12, 12', so as to provide a carpet having a different colour on the top layer exposed to the view, when the carpet is reversibly laid on the floor.

The invention provides that the exposed surface of said outer layers 12, 12' right from the making of the semi-finished layer, be embossed in order to make it less slippery or, alternatively, that said surface be coated with a protective and reinforcing film made of an embossed polyethylene material.

The modular carpet panels are peripherally indented according to a pattern of symmetrical groove and tongue joined elements, as schematically shown in Figure 3, which is a top view showing the corner regions of two panels A and B to be coupled to one another along their respective sides.

By fitting the male portions A1, A2..... of the panel A into the corresponding recesses B11, B12,..... of the panel B and vice versa, the panels can be accurately coupled to each other, as shown in Figure 4, wherein, on the left side of the figure, is left free an indented ledge, which can engage other panels for completing the carpet or, in the case of an outer panel, the latter can be completed by a side bordering ledge C, shown in Figure 5, having an inner periphery with groove and tongue indentations and a linear outer periphery, which is supplied together with the panels.

In addition to the linear bordering ledge indicated by C in Figure 5, there are also provided complementary bordering elements D (Figure 6) having, at their inner surface, indentations which can be arranged at the corners of the panels A and B shown in Figure 4 and which have smooth outer sides, forming an angle of 90°.

The groove-and-tongue elements schematically shown in Figures 3, 4, 5 are made according to a geometrical pattern so that the faces of the male and female elements, which will contact one another in order to provide a homogeneous transmission of the stresses developed between two adjoining panels, form an angle of 45°.

As shown in Figure 7, in order to meet the above mentioned geometry with angles of 45° of the side surfaces of the groove-and-tongue elements A1, A2... and B1, B2... connecting the adjacent panels A and B or bordering ledges C and D, said elements are formed by fol-

lowing the trail of a theoretical indentation provided with saw teeth in which the angles α of the apexes M, N, O, P... all have the value of 45° . By selecting a suitable height h for the groove-and-tongue elements, said height is divided into like parts with respect to the theoretical middle joining line of the two panels, indicated by k , thereby obtaining the base lines m and n delimiting said groove-and-tongue elements, which will be equal to one another if the line k intersects at mid-height the isosceles triangles N-O-P or the like, as shown in Figure 7, wherein the point Z is arranged at the middle point of the height O-V of any triangles N-O-P.

In order to provide male and female groove-and-tongue fitting elements having walls which are perfectly flat and vertical, so as to obtain a coupling without any voids, the cut is preferably performed by a high pressure water jet, which has been found to be the sole inexpensive and quick cutting system apt to prevent a curved cutting of the surfaces which would otherwise be inevitable if the cutting were performed by a conventional die cutting operation on a yieldable materials such as a polymeric foam material.

Obviously, in order to prevent the formation of sharp corners, the indentations exhibit a rounded configuration as shown in Figure 7.

The opposite corners of each panel have been designed to be the same (see Figure 3), for example the bottom left corner and top right corner of the panel elements A, B... will form a W-shaped recess corresponding to two adjacent halves of the female recess, whereas the left top corner and right bottom corner will form a V-shaped recess corresponding to a half female recess.

As materials to be used for making the carpet according to the present invention, in addition to polyethylene, also other foam materials, e.g. polypropylene, polyurethanes or other known compounds suitable for making foam materials, can be employed.

Claims

1. A carpet for special sport matches such as wrestling, judo, karate and the like, characterized in that said carpet consists of modular elements (10), each of which comprising at least three layers (12, 14, 12') of a polymeric closed cell foam material, the outer layers (12, 12') having a density greater than that of the inner layer (14) in order to provide an assembly which is comparatively rigid under a normal trampling condition and sufficiently yielding in case of localized impacts, caused by falls of the competitors, which modular elements can be mutually coupled by peripheral male and female indentations which can be joined to one another by a groove-and-tongue fitting.
2. A carpet according to Claim 1, characterized in that the elastomeric foam material forming the layers of the modular elements of the carpet (10) may be any suitable closed cell foam material, such as polyethylene, polypropylene, polyurethanes and the like, preferably polyethylene.
3. A carpet according to Claims 1 and 2, characterized in that the density of the outer layers (12, 12') of the modular element (10) varies from 30 to 200 kg/m^3 .
4. A carpet according to Claims 1 to 3, characterized in that the density of the inner layer or layers (14) of the modular elements varies from 25 to 50 kg/m^3 .
5. A carpet according to Claims 1 to 4, characterized in that the thickness (a, a') of the outer layers (12, 12') of the modular elements varies from 5 to 25 mm, preferably from 10 to 20 mm.
6. A carpet according to Claims 1 to 5, characterized in that the thickness (b) of the inner layer (14) of the modular elements varies from 1 to 2.5 times the thickness (a, a') of the outer layers, preferably from 1.5 to 2 times said thickness (a, a').
7. A carpet according to Claims 1 to 6, characterized in that the outer layers (12, 12') of the modular elements are of different colours.
8. A carpet according to Claims 1 to 7, characterized in that the peripheral indentation of the individual male and female (A1, A2....; B11, B12....) modular elements preferably follows a groove-and-tongue pattern (Fig. 7) in the shape of isosceles triangles (N-O-P, O-P-Q), the sharp corners (N, O, P . . .) of which form an angle (α) of 45° , and in which the middle line (k) joining two panels (A and B) intersects the height (O V) of any said isosceles triangles (N O P . . .) at a middle point (Z), the height (h) of the grooves and tongues (A1, A2 . . .) (B1, B2 . . .) being symmetrically distributed at said joining middle line (k).
9. A carpet according to Claim 8, characterized in that said grooves and tongues (A1, A2 . . .) (B1, B2 . . .) are preferably made by a high pressure water jet die cutting operation, so that the surface of the single tongue elements is flat and perpendicular to the outer surface of the panels, the sharp corners and recesses of the male and female elements respectively being rounded.
10. A carpet according to Claims 1 to 9, characterized in that the outer surfaces of the layers (12, 12') of the carpet modular elements are embossed or, alternatively, coated by an embossed polyethylene film.

11. A carpet according to Claims 1 to 10, characterized in that the thickness (a, a') of the modular element outer layers (12, 12') is the same.
12. A carpet according to Claims 1 to 10, characterized in that the thickness (a, a') is different. 5
13. A carpet according to one or more of the preceding claims, characterised in that the modular elements (10) consist of outer groove-and-tongue joined panels and of bordering ledges (C), as well as inner groove and tongue elements (D) forming an angle, having an outer linear periphery. 10
14. A method for making a carpet for sport matches, characterized in that it provides for bonding to one another the two outer layers of a closed cell foam material having a substantially high density, between said outer layers being sandwiched at least one layer of material of lower density, e.g. by thermosealing or any other known methods. 15 20
15. A method for making a carpet for sport matches according to Claims 14, characterized in that said multi-layer material is preferably cut by high pressure water jets to provide the modular elements (10) according to Claims 1 to 13. 25

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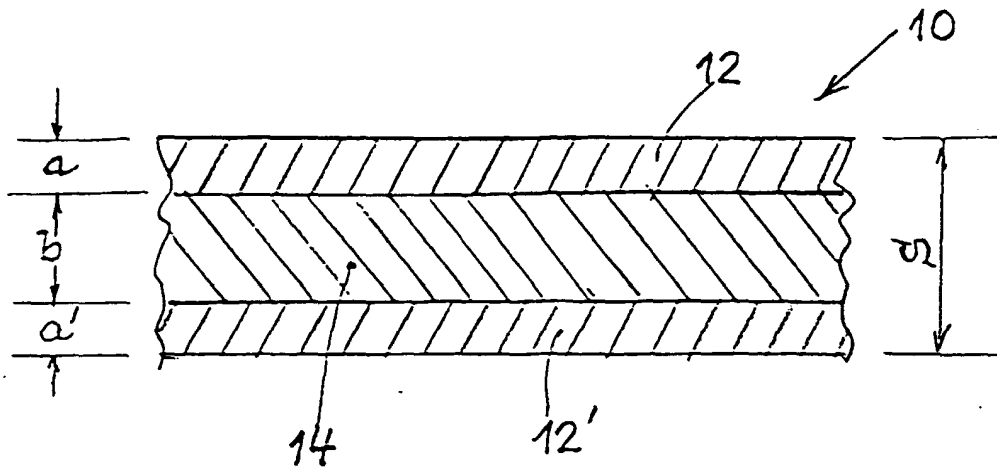


Fig. 1

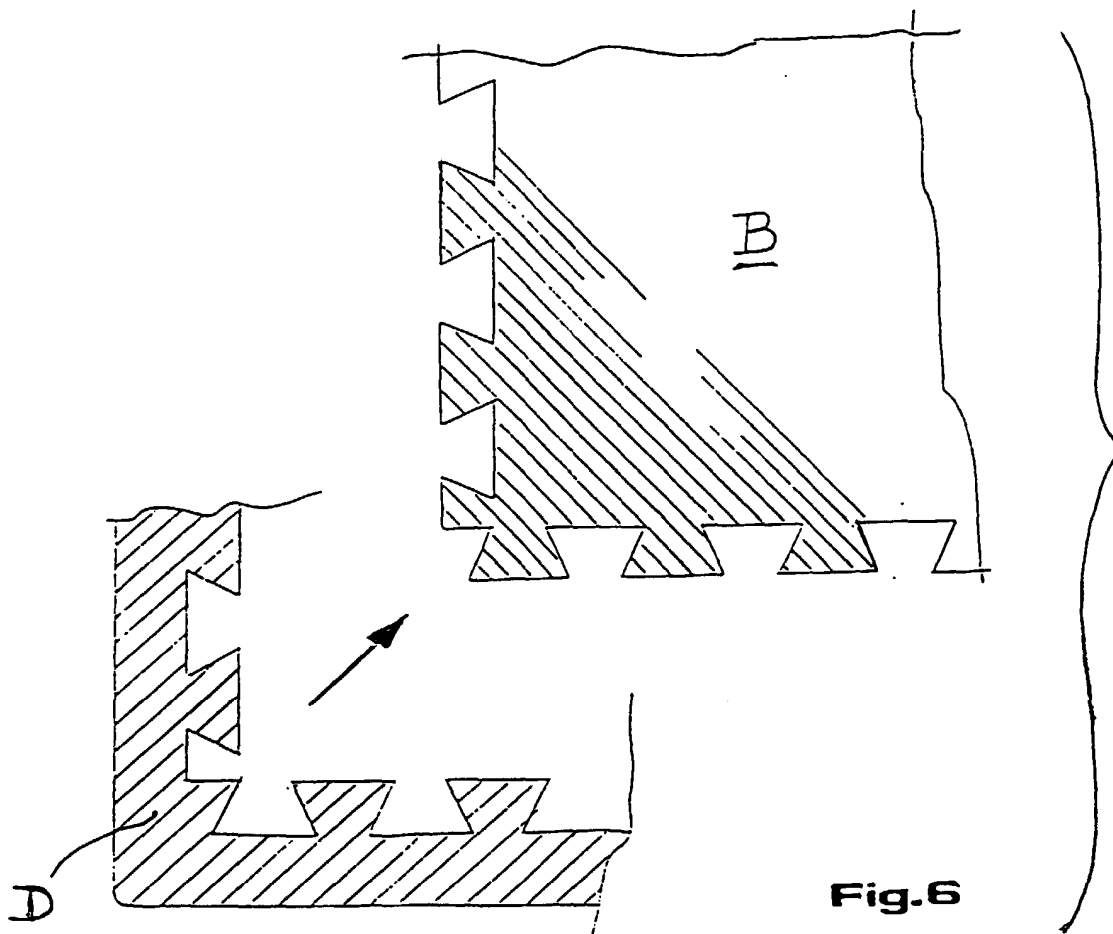


Fig. 6

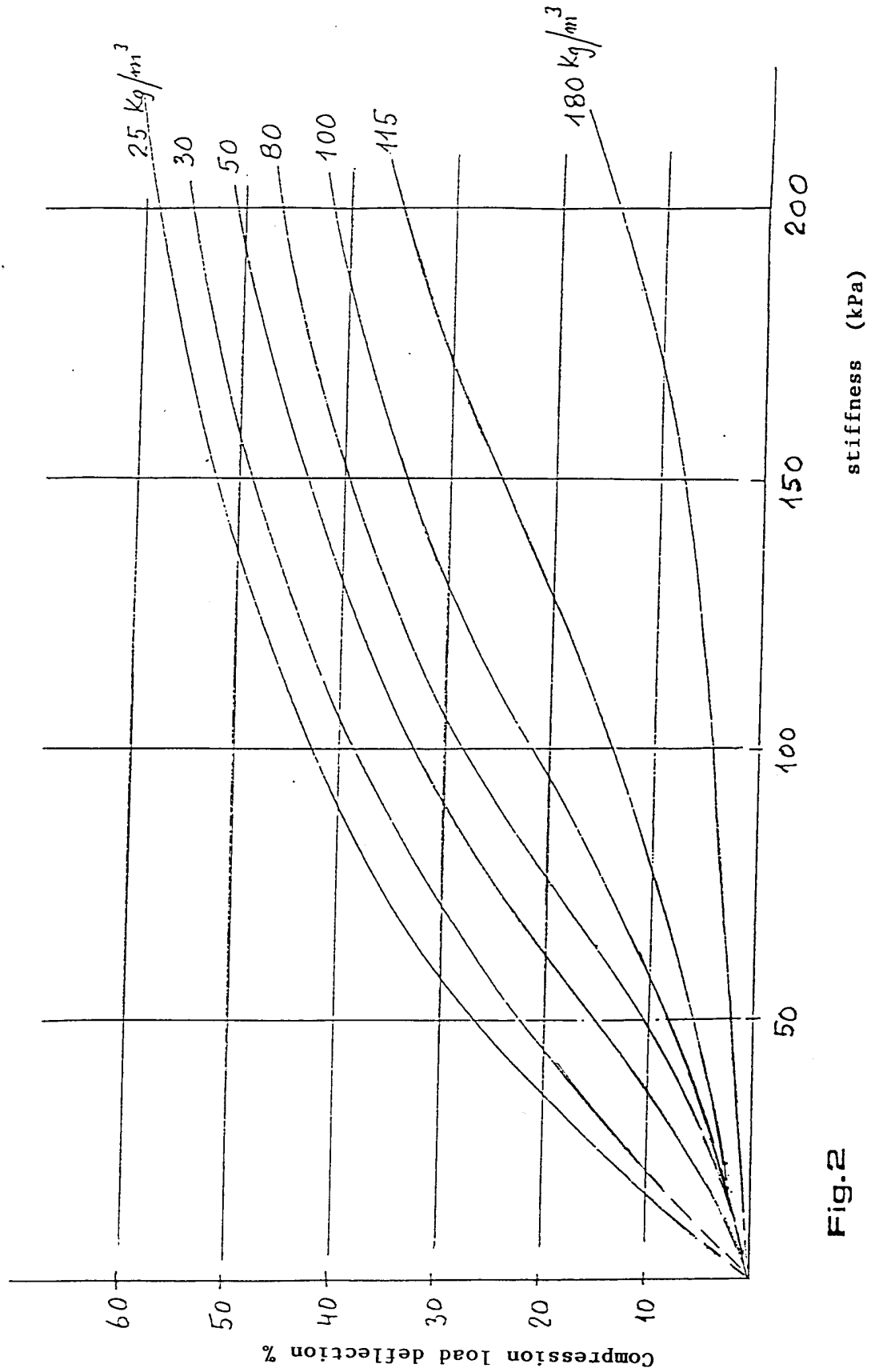


Fig.2

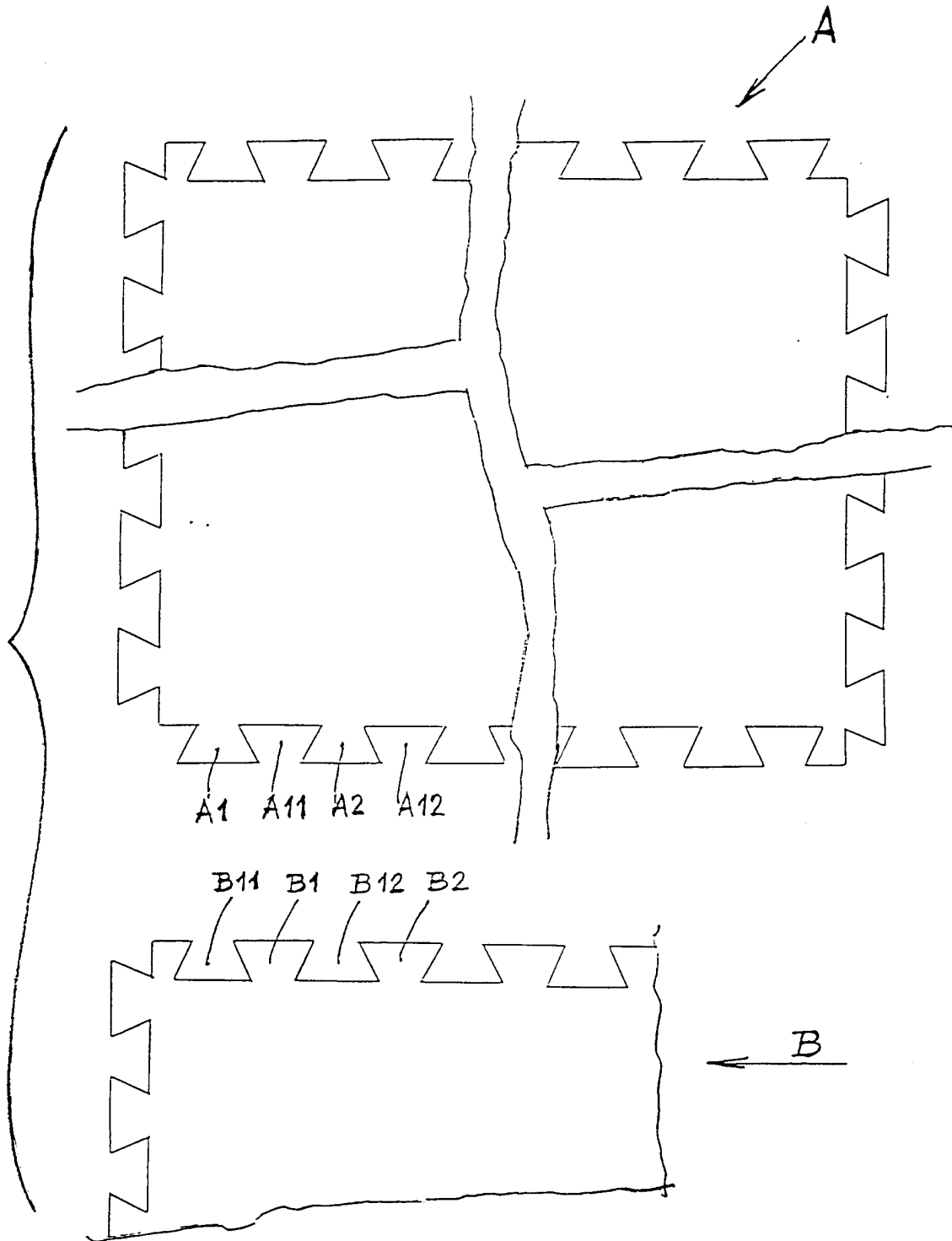


Fig.3

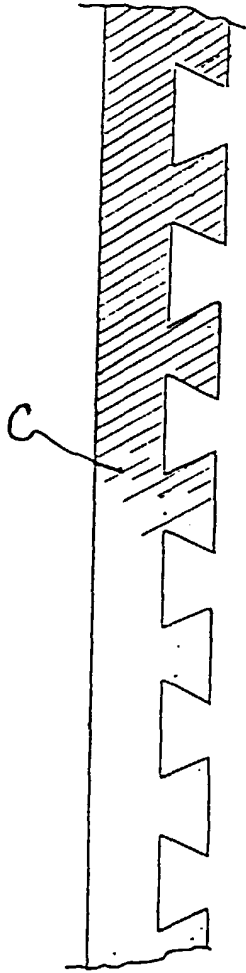


Fig. 5

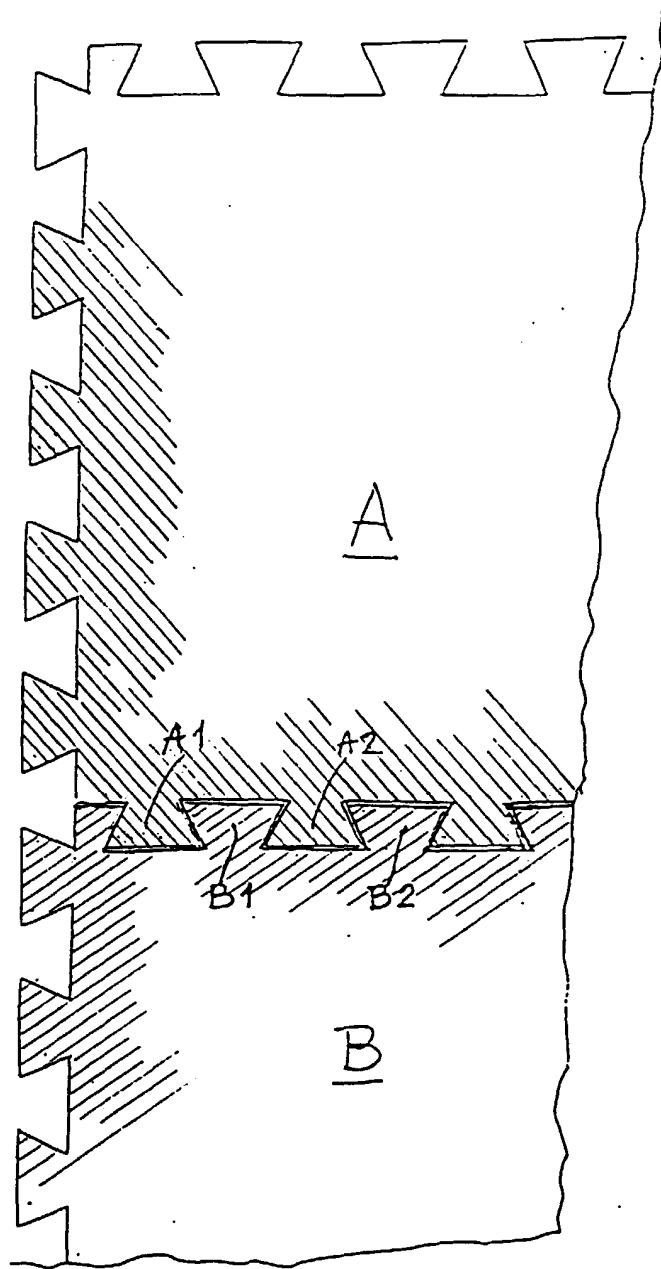


Fig. 4

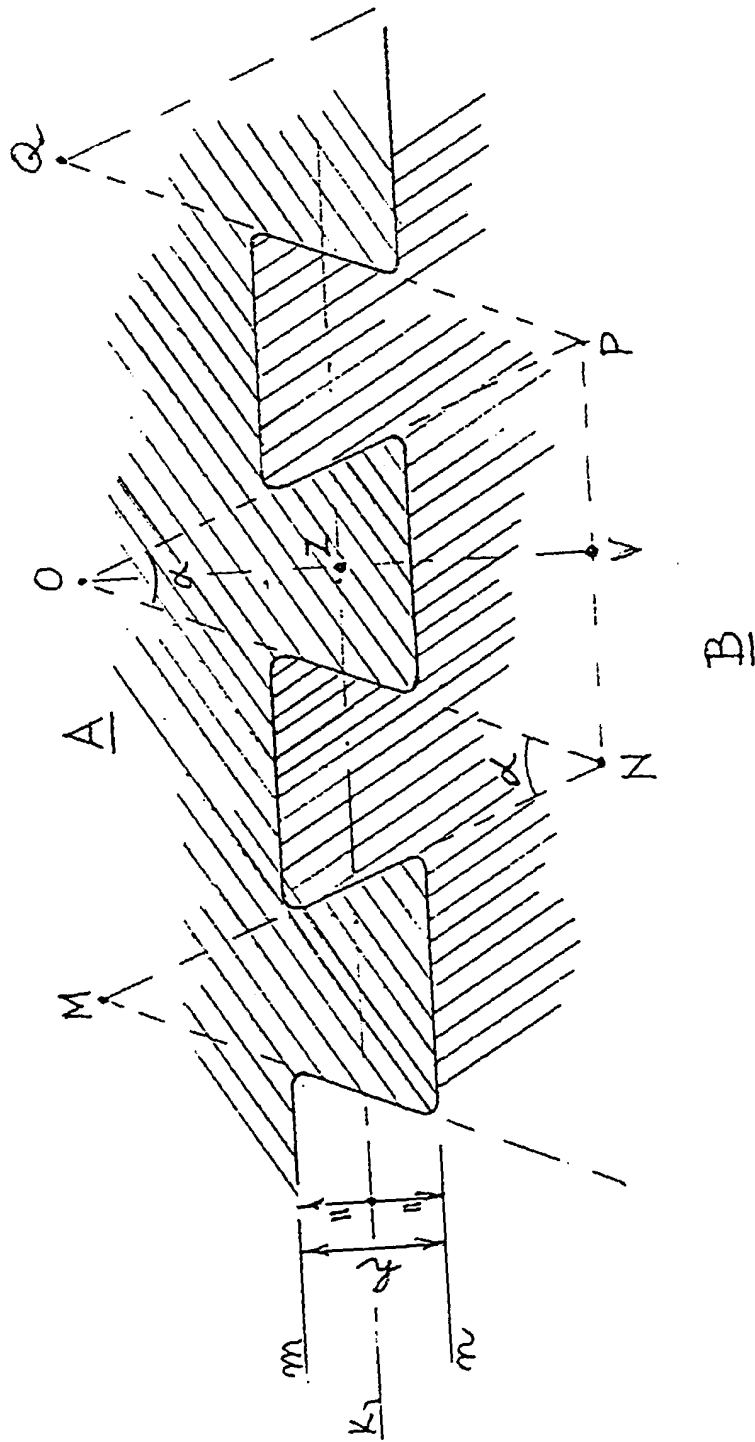


Fig. 7



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EUROPEAN SEARCH REPORT

Application Number
EP 98 11 1264

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	DE 20 03 683 A (H GROH) 12 August 1971 * page 2, paragraph 3 - page 4, paragraph 1 *	1	A63B6/00 B32B7/02 B32B5/32
A	DE 19 63 304 A (W SCHLAIER) 24 June 1971 * page 1, paragraph 3 - page 3, paragraph 2 * * figures *	1	
A	US 3 709 966 A (M GAMBARDELLA) 9 January 1973 * column 11, line 40 - column 12, line 20 *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			A63B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 15 October 1998	Examiner Vereecke, A
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